Journal of the Society of Arts.

FRIDAY, DECEMBER 26, 1856.

IMPROVEMENTS IN MACHINERY.—RACES OF WORKMEN.—NOMINALLY LOW-PRICED LABOUR.

Sir,—As it has been put forth in the Society's *Journal*, by Mr. Bridges Adams, in his comments on a portion of my address at the Congress of Bienfaisance at Brussels, that people of France, Germany, and Italy "were willing to work for such small wages that the English manufacturers were cut out," I must request the insertion of the context of my address, containing references to parts calculated to disabuse his mind, and the minds of other employers, of the large fallacy that, as compared with Continental labour, English labour in general is dear labour. I know nothing of the manufactures of Spain; but from large manufacturers in France, Switzerland, Austria, Italy (several of them using the latest and the best of the English machinery), I know that, by whatsoever the English manufactures have been kept out, it has not been by the cheaper labour of those countries. In his comments, Mr. Adams dogmatises, as it appears to me, on assumed inherent inalienable qualities of races as workers, in a manner which is as unfounded as it is mischievous. As the subject is one of great importance, I beg to direct attention to those facts in the context, showing the different working of the same races under different conditions. Nothing is easier, or more common, than to say of a particular class of men, that they are of a particular race—*i.e.*, our own—and, therefore, infer that all is good about them; that another class are of another race, and therefore that they are essentially inferior, bad, and hopeless. I do not deny the force of hereditary conditions and habits which countenance such superficial generalisations, but I have seen that these conditions and habits may be much sooner, and more effectually altered, than is commonly supposed. I might adduce instances of classes of children of hereditary Irish mendicants, converted, by education and training, into orderly and steady productive labourers; of Saxons having the habits and inferior condition ascribed as peculiar to Celts,—and of Celts, working like superior Saxons; of trained and educated Irishmen, and also of trained and educated Welshmen, having been preferred in Scotland and England, as workers—and officers, for qualities, vulgarly assumed to be peculiarly Saxon—namely, superior steadiness and sobriety of mind; hovel-bred Irish emigrants, revolting against going in the same emigrant vessel with some German emigrants, on account of the filthy and inferior habits of the Teutons.

I regret to see such statements put forth in the Society's *Journal* as that, in Lancashire "nominally free people became slaves of the mill, as much as black men were slaves of the sugar cane;" the fact being, that they are as little slaves to the mills as any of the rest of the community who are compelled to labour for their livelihoods at some pursuit, whether manual or mental, or professional, are slaves in his sense to their respective occupations. His assertion, "that there can be no doubt of one fact, that spinners and weavers were either born or bred a distinct class from the general mass of British people, who gained their living by athletic and open air labour, that they are lower in stature, paler in complexion, more delicate in nervous organisation"—might as well be applied to tailors or shoemakers, or to lawyers' clerks, who present in these respects an unfavourable contrast to farmers. If he had informed himself of the origin of the cotton manufactures, he would have been aware that the workers are taken from the general local population; and that only when that population was insufficient were hands sought from a distance (also taken from the general population); and that cotton mills are frequently set up at a distance from the towns and markets, in rural districts, for the sake of the cheaper labour there obtainable from the rural population. Indeed, to meet a demand for additional labour in the mills, in 1836 I promoted a migration of agricultural labourers and their families from overburthened agricultural parishes in Buckinghamshire, and others of the most pauperised counties, who soon became good cotton workers, at double their previous wages. Instead of the hand-loom weavers being born and bred a distinct class from those who gained their living by athletic and open-air labour, the first were commonly taken from the class of small farmers, and examples may, I believe, yet be found of the primitive class who alternately tilled the field and plied the loom.

In machine spinning, I have understood that dexterity is required only for piecing the thread; and that its formation does not, as with the distaff, depend on delicacy of handling. Whilst machine-work does not exclude robust hands, it is its recommendation that it admits the labour of young persons.

In 1842, in the Report on the sanitary condition of the labouring population of Great Britain, I endeavoured to direct attention to the great extent of preventible mortality amongst artizans, and to the need of discriminating how much of this is due essentially to occupations, and what is separable from them: how much is due to the present habitations, and how much to the present habits. I showed that, the conditions of work in cotton mills being the same, there was one-fourth less of mortality amongst the operatives living in a rural, as compared with that prevalent amongst those inhabiting an urban district; that it made ten years' difference in the working ability, particularly in the duration of the eyesight, of a tailor, whether he worked with numbers in a London shop, or singly in a shop in a rural district,—in which rural shop there is still room for considerable improvement. Though warm air and, in particular hygrometrical conditions of the atmosphere, additional moisture, may be required for cotton spinning, it need not be, as it now too commonly is, impure air. The "pallor," the "lowered stature," the "delicacy of nervous organisation," are little due to the occupation, but mainly to the low state of sanitary science, and the want of architectural skill for its application. Indeed, in mills of a superior sanitary condition, as to ventilation, lighting, drainage, &c., the warmth and steadiness of temperature are found to be favourable to various complaints, as those of a scrofulous character.

In answer to Mr. Adams' representation, that "Lancashire cannot grow men and women, for if she ceased to import them they would disappear in a few generations, *i.e.*, men and women fit for cotton spinning," it is proper to give my assertion in the context, of the real condition of the general labour of that district, after all causes of deterioration (which no one, that I am aware, has more fully shown than myself)—that it is the seat of the foremost working population in Great Britain, of which I have strong evidence—such as of manufacturers having manufactories in other parts of the country, who, when they have orders to execute against time, always endeavour to get them executed in Manchester. The sons of strong six feet men in the rural districts may have been deteriorated in the towns to five feet ten inches, or lower, but in the judgment of the army surgeons, not many of them yet below the army standards, even by the particular occupations objected to as requiring and creating an inferior class; for I find, in Major Tulloch's last returns of the occupations of 22,000 pensioners, no less than five thousand seven hundred and thirty "weavers, spinners, and clothworkers,"—of which brigade it is well known that Lancashire will have furnished the largest contingent. Cromwell said

of the Lancashire militia, that "finer soldiers or greater plunderers he never saw in battle-field." The Guards, who were acknowledged to have been the finest of the soldiers in the battle-fields of the Crimea, have usually been drawn in the greatest numbers from the seats of the navvies in Lancashire, with additions from the contiguous hill districts of Westmoreland and Yorkshire; and it will be acknowledged that, whilst they have maintained the character which Cromwell gave them as soldiers, they did nothing to revive the stigma which he fixed upon their ancestors as plunderers.

The members of the Congress, however, will acquit me of any intention of feeding provincial or national vanity, or of vaunting our strength. They will have been well aware that my object was to display some elements of progress, and to direct attention to the conditions by which strength was gained, and by which the weakly in this country, as well as on the continent, may be elevated. If those conditions should be found applicable to the Indian races, they will now be more free to apply them than ever, and may have the aid of British capital, —and for their home consumption there will always be the heavy bounty of the cost of transit half way round the world and back again, and various intermediate profits to be saved. But the supposed cheap labour of the Egyptians, probably of the race of the most primitive fine spinners by-hand labour, has not hitherto availed the efforts made to extend the cotton manufacture in Egypt.

As in speaking of the eldest living member of the House of Commons, as the father of the House, I should not be supposed to ignore Simon de Montfort, so in speaking of Mr. John Kennedy as the father of the cotton trade, few would have supposed that I intended to ignore Arkwright. I spoke of Mr. Kennedy as Mr. Bazley, the Chairman of the Manchester Chamber of Commerce, spoke of him in his address to the Society, and as Mr. William Fairbairn and others have spoken of him. The citation of him, as a competent authority, may be justified by reference to his papers "On the Rise of the Cotton Trade," and "On the Influence of Machinery," in the Manchester Philosophical Transactions.

I am, &c.,
EDWIN CHADWICK.

The following is the context of the address referred to:—

"It need not be enforced how strong is the interest which a nation has in the improvement of its agriculture; but I am a great advocate for agricultural improvement, for this especial reason, amongst others, that I have found, as a general rule, improvements in agriculture can only be effected through an intelligent and improved class of labourers. From particular inquiries which I have made in various parts of England, I am assured that in agriculture, as in manufactures, wheresoever labour-saving machines have been introduced, or labour-saving improvements in processes have been effected, more labour, of a higher quality, and better paid, has been required. At present, one great practical barrier to improvement in agriculture is the intractability, from ignorance and general low condition, of the labourers. It is a question, and a question overlooked in the consideration of the economy of sound popular education, whether there are not more successful inventions of machines and processes, especially in agriculture, unused than are used—essentially successful inventions and processes having been abandoned on account of the obstacles arising solely from the want of intelligent labourers to apply them. Thus the reaping machine was found to be an invention made a quarter of a century before, but abandoned. A friend of mine, an able mechanist (the late Mr. Smith, of Deanston) had invented one which succeeded in the field, but was destroyed in the barn by the ignorant carelessness of his labourers. At present, it is common for an agriculturist, after the inspection of a machine at the manufacturer's, to say, 'Well, if I buy that machine, you must find and send me a labourer to work it and take care of it, for I know of no one in my own parish who is fit to be entrusted with it.' 'But what wages do you give?' the machine-maker asks. If it is a Dersetshire or a Buckinghamshire agriculturist, 'Eight or nine shillings per week,' will be the answer. 'But those wages will not do,' says the machine-maker. 'You can only get a labourer fit to be entrusted with that valuable machine at sixteen shillings a week.' And if the machine is taken, in one form or other the condition of the increased wages is generally submitted to; and so, under an impulse for economical improvement, improved labour is introduced.

"A quarter of a century ago there were agricultural riots, in which labour-saving machines were broken; and the popular violence was justified, and the use of machinery was discountenanced, even by members of Parliament. We are told that it is the political economy of the Chinese to prevent the use of horses in order to sustain the stock of labour for men; all they succeed in doing by this policy is, to make men do the work of horses, and in that respect to confine them to the condition of horses in perpetuity. In some of the agricultural districts in England better views have now begun to prevail, and labourers have refused to do thrashing work by the flail, because, as they have justly and laudably said, that was work for a machine, which they would not degrade themselves by performing. It is now a common effort of intelligent agriculturists to give their labourers an interest in the use and success of machines; and that interest, they find, must be improved wages or condition to the labourer. The most improved agricultural labour is conducted by well superintended labour, at piecework; and that description of work can only be well obtained permanently, by full payments, to sustain the interest in it; and that interest is, to a great extent, independent of the question of supply and demand.

"This is a topic which I believe to be of vast importance to the future of the labouring classes, though I have only the means of indicating some of its economical bearings.

"In treatises on agriculture by persons of authority, one or other course of agriculture is recommended to be adopted, as the labour is said to be dear or cheap. Now, from considerable observation in England, and from such information as I have been able to obtain, low-priced labour rarely is cheap labour, either in agriculture or in manufactures.

"An eminent manufacturer and successful manager of labourers stated to me, in the way of illustration, that it was with his workmen as it was with a valuable horse-power machine. 'I cannot,' said he, 'afford to work my machine with a horse that costs less than £30, or eats less than eighteen pounds of oats a day.' As it was with the horse, so it must be, under ordinary circumstances, with men—the eating the corn, the sufficiency of food and comforts, the existence of objects of desire, to create an interest in the work as a means of obtaining them, are becoming more and more positive conditions; for, whatsoever be the number of other horses in the market, the work will fall off unless the horse have his 18lbs. of oats. I have ascertained in England that in highly cultivated districts, where agricultural labour costs 14s. and 16s. per week, the work is, for quantity, as cheap as in districts where agriculture is lower, and where wages are only 8s. or 9s. a week. Nay, we have in my county—Lancashire—a class of workmen strangely called navigators, or 'navvies,' it is supposed from having been originally employed in digging canals and works for serving inland navigation. These Lancashire men work in gangs of five, and will admit no men into their gangs who cannot, as their minimum task, load twenty cubic yards or twenty single horse-loads, of earth in a day. I have known instances of men of this class, as a feat, doing even double that quantity. A mile of road made by labourers of this superior class, earning 3s., 3s. 6d., or 5s. 6d. per diem, has been executed in a much shorter time, and has been finished as cheaply as a mile of precisely the same sort of road done in Ireland by pauper labourers whose wages were only 1s. per diem. Common agricultural labourers, when they have been allowed to join these gangs of navvies, and have been 'alimented' and seasoned to their tremendous discipline, on their return have astonished the farmers by doing an ordinary day's agricultural work before noon, and by putting their spades on their shoulders, and going away for the rest of the day. My noble friend, Lord Shaftesbury, brought down to his estate in Dorsetshire a foreman accustomed to superior labour at piecework. Judging of what would be his answer, I said to this foreman, 'Will you not get this work done cheaply; here the labourers are got for only eight shillings per week?' 'But *they* would be dear at *six*,' was the reply. 'How is it here with your other classes of artizans?' I inquired,—'your journeymen bricklayers, for example, what sort of workpeople are they?' 'Such as from their wages you, sir, would expect,' was the answer. 'And what wages are those?'—'About twelve shillings per week.' 'And how many bricks do they lay in a day?' 'Not more than between three and four hundred.' 'And how many do your town bricklayers lay, to whom you

pay double wages?' 'More than a thousand a day!' was the answer.

"The same agricultural labourers on that estate, when put to piecework for draining, and made to earn nearly one-half more wages, were, by higher food, soon put into a superior physical condition. The labourers two years ago earning but 7s. a week, are now, through piece work at the drainage, earning many of them 15s., many 18s., a week; and these are hearty hale young men, who, at the beginning, openly stated their preference of 7s. a week with light labour, to twice the sum with increased exertion. Besides the labour which demands great vigour, there is the labour in agriculture which demands great skill; and skill is more productive than ordinary agriculturists are aware of. I was staying recently with a friend, an eminent and successful English agriculturist, Mr. Huxtable, who, whilst I was with him, saw a boy conducting a new spring waggon over the ridges and furrows of a field in such a manner as to endanger the waggon, when my friend ordered a man to take charge of it, and reproached his bailiff with his wasteful improvidence in entrusting so valuable a piece of machinery as that waggon and the horse to a boy. My friend observed, moreover, that an intelligent driver, who would load properly and conduct a horse carefully, was, for the saving of the horse as well as the machine, worth his double wages; that even in the common operation of digging, one labourer who was skilful was more profitable to him at 12s. than another was at 8s.; and so with other agricultural processes. The same eminent agriculturist has, with the aid of steam and improved machinery, processes and labour, brought the land of the average annual rentals of that country —namely, 5s., 9s., and 15s. per acre land—to an improved average value of 30s. per acre per annum; and this advance has been made with a return of 10 per cent. on the capital invested. Now there is no other reason than mere ignorance and routine why the whole of that country should not be cultivated in the like manner as this one portion of it. But if it were so, Dorsetshire, instead of being cultivated by only 16,000 labourers at only 8s. or 9s. per week wages, would require for its improved culture between 30,000 and 40,000 labourers, at 10s., 12s., 14s. and some of them 16s. per week. And this country is to a greater or lesser extent an example of what may be expected of agricultural improvement throughout the whole kingdom; and that improvement, whilst it must raise wages to the agricultural labourers, and remunerate the capitalist, would cheapen food to the general population.

"The most eminent of the 'navvies' in England come from the hill districts of sandstone-grit and granite in Lancashire and other northern counties, where there are favourable sanitary conditions of pure soft water and forced ventilation, and some natural drainage by winds and storms. Their alimentation, too, has been generally good. Some of the leading navvies have represented to me that they consider eleven pounds of meat per head per week, a necessary of life for good work; but I should not accept this as to the species of diet as an absolute dogma, for they, themselves, have admitted to me that eaters of oatmeal and potatoes (with milk), though in great quantities, have done good work with them; what, however, appears to be certain is, that a superior alimentation at the least is required, though it is by no means the sole requisite, and mental as well as bodily stimuli are needed for the attainment of superior work. M. Nidault, a French engineer, in his treatise on irrigations, gives the following account of a similar class of labourers to those by some deemed peculiarly our own. He describes as a most interesting class those who devote themselves specially to the execution of canals and other irrigation works in Italy. 'It is,' says he, 'that of the small contractors, or simple task-workers, who bring with them a gang of workmen, at the head of which they work, and by whose means they can advantageously contract for considerable works, especially digging or levelling. The digging of an irrigation canal, if rather a large one—one, for instance, of seven to eight metres wide, and which may also serve for navigation—is one of those works, which, to be well done, should be done with promptitude, or at best, without any delays, which requires that a number of workmen should be concentrated at one point. The resources of the locality being generally insufficient, they are obliged to seek labourers in the neighbouring districts, and prefer applying to the poor and populous countries such as Savoy and German-Lombardy. It is true that there they can find cheap labour, but at the same time the labourers are without vigour; and though they may be contented with small wages, they will also give very little work. I have always found the other system much better, which consists in employing those who gain high wages, but who also work well. There is not an engineer who would not agree with me on this point. There are some who would say that, in certain satisfactory results, obtained by different causes, this element has been the principal one of success.

"From time immemorial, the Piedmontese provinces of Ivrée, Brille, Varillo, and others, but *especially the high country near the lakes*, including the cantons of Arona and Bellazona, are in the habit of sending every year into other countries a considerable number of active and industrious men, who represent precisely this class of small contractors, the employment of whom has generally the best results. Many of these migrants are painters, plumbers, chimney-doctors, and decorators; but their most remarkable talent is that for 'navvying,' and for this qualification they are sought at great distances, as they will be wherever their work can be appreciated. In those *healthy* districts the peasantry have had for *a great number of generations substantial food*, as is generally the case in irrigated countries, where cattle are numerous. It is doubtless by these means that the Piedmontese 'navvy' is so indefatigable, and also exempt from the diseases that generally prevail amongst the labouring classes. I have seen them, without suffering any injury from it, remain twelve hours working in a deep cutting, with their heads uncovered, where the reverberation of an Italian sun would have been intolerable to men of any other mould. It is to be observed that they execute quickly and well whatever they undertake. To see them form a slope (*dresser un talus*), or dislodge a rock, either with the pickaxe or with powder, one cannot help asking—Are they not rather artists than labourers? For they have the secret of combining an extraordinary speed in the work they undertake, with the most perfect execution; and herein lies their great value. They will not accept work by the day; but it is not their habit to work lazily, and even the highest wages barely remunerate their labour.

"The most skilful of these labourers—those who have saved a little money—become contractors, or task-workers. They have a gang of twenty-five to thirty, or even a 100 to 150 picked men, that they take with them wherever they are required, and undertake works of great importance for a fixed sum. If more workmen are needed than the gang contains, the contractor sends for more. He knows exactly where to apply in case of necessity. They know certain villages in Germany where they go to recruit their gang, as the officers of the army go for their horses. 'This class of men,' says this French engineer, 'is entirely wanting in France, and it ought to be formed and encouraged.'

"In England I have written pamphlets, and got a parliamentary committee of inquiry, and done whatsoever was in my power to prevent the valuable class of labourers which we have already formed, though rudely, from being deteriorated and destroyed by the reckless and discreditable administration of railway works. I observed also, and endeavoured to call attention to the fact, that the sons born in towns from these hill district labourers were shorter and less strong than their parents, and that the parents who came to reside in the towns, in consequence of the defective sanitary administration there, lost on the average about ten years of working ability, as well as of life; and that of the fine children born of this class in the towns more than forty per cent. were destroyed by preventible disease before their fifth year; but hitherto the efforts of powerful friends, with myself, in this case, have been only of partial effect.

"I may observe, *en passant*, that I have been informed of one other similar class of labourers to our navvies, the *terrassiers*, who come from near the Polders, of whose condition I have not obtained particular information; but English navvies have been much employed on railway works in France, and have earned as piece-work from 7fr. to 8fr., and in some instances as much as 10fr. per diem; and they have also in various parts of Germany earned double the best labourers' wages there. And this superiority, I may say, of a highly alimented and skilled labour, has been maintained in every clime. A friend of mine, a civil administrator in India (the Right Hon. Holt Mackenzie), informed me some time ago, that he had made a note of the comparative cost of Indian, Chinese, and English labour when he was in India, and that the general result was, 'that for some works an English workman, of average efficiency, was equal to several Chinese, and one Chinese equal to several Indians (Bengalese); and this independently of the advantage or disadvantage of the tools employed. And the conclusion I drew,' said he—and the conclusion which, I too, wish now to enforce—'was, that for estimating the cost of labour, or of the work done, there could not be a worse standard than the wages of the labourers.'

"Much in this instance might be ascribed to the climate; but the spectacle has been presented in Calcutta of Lancashire artizans, imported at high wages, doing work there under the shade of umbrellas held over them by Hindoos, engaged at low

wages to attend and perform this service. Labourers of our Army Works Corps speak with respect of the capabilities of the Turkish labourers, and of particular feats of strength performed by them; but Mr. Rawlinson, our sanitary engineer, declares to me that the Croat labour, chiefly engaged by us in the first instance, was dear at sixpence per diem; and that in relation to the works performed in the East, by whatsoever race, it would have been far cheaper to have taken out highly paid and trained English labourers and materials, all the way from England, for the execution of the works. In the course of discussions on the subject with the members of the congress met here, I have received much testimony confirmatory of my view of the facts. One member of the congress, a merchant, informs me that he has had ships built abroad, and also ships repaired in every principal port of the world; but he avows that notwithstanding the very high wages of our shipwrights, he has found their labour as cheap as any he has elsewhere met with. In respect to agricultural labour, another of our colleagues, a land owner in Poland, who has been some years in England, and who has studied its agriculture, states to me that he found one German labourer equal to two Polish labourers; but that three Polish labourers—and those not serfs—were required to do work equivalent to one average English agricultural labourer. In this extreme difference, however, the difference of tools was included with the difference of skill and energy. Another Polish gentleman here, who studied at the English Agricultural College at Cirencester, states to me that he compared the expense of the ploughing done there by ploughmen at 14s. per week wages, with an equal quantity of ploughing done on his father's estate in the accustomed way there, and he found that the work done at Cirencester had the advantage in cheapness. On a particular comparison made in Normandy, the labour of three Norman agricultural labourers was found to be equivalent only to that of two English, or more particularly two Kentish labourers; and from other information which I have received from engineers, confirmed by members of the present congress, about three Danes, or Norwegians, or Swedes, would be required to do the same quantity of work as two average English labourers. Superior workmanship, as well as quickness of execution, with the aid of superior tools, will frequently tend to augment the value of the English labour beyond the difference of the gross produce. Admirable work is done by Anglo-Saxon men in Canada, and in the United States of America; but I repeat, that I do not ascribe the difference of result mainly to race, because, as I have observed, the labour of Englishmen, depressed by maladministration and pauperism, is often as inferior as any other; and because depressed Irish labourers, when put into suitable training and condition, are found, according to the acknowledgment of English labourers, to keep step with the best. Indeed, in the Crimea, under the directions of our army administration, the ordinary labour and tasks of earthwork required from soldiers—raised chiefly from those same districts from whence the best navvies have been obtained, and acknowledged by impartial observers to have in physique no superiors amongst all the troops in the field—were only to remove ten cubic yards a day in a loose soil; that is to say, that at least two soldiers were required to do the work done with an interest and a will by one navvy—the navvy very often the brother or relation of the soldiers, or coming from the same villages.

"I am glad to find that the general observations of the most eminent continental agriculturists—of Count Gasparin in France, of Van Thüer and Burger in Germany—are in accord with my own in England—I regard the economical element which those facts display to be of the greatest social and political moment; for on this economical element will depend, not only the extinction of every form of serfage, but of slavery itself. I have been consulted on drainage as sanitary works by proprietors in the West Indies, and have had some insight into the slave labour there; and I am convinced it is dear labour, as contrasted with the white free labour. Slavery will sooner fall with our brethren in America when they find it, as they eventually will do, as compared with improved free labour culture, bad as an investment, than by any amount of condemnation of it, as being bad as a social institution. It appears to me that Count Gasparin justy cites, as an instance of the power of free as against slave labour, the fact that the manufacture of sugar from the beetroot keeps it ground; that is to say, that the slave (or the slave bred labourer), with a plant containing 18 per cent. of sugar, grown in a superior climate, has great difficulty in contending against the free labourer, who cultivates a plant which contains only 8 per cent. of sugar, in a climate most unfavourable to its development.

"In England, I have known agriculturists from the most advanced districts of the North, tempted by the cheaper land, the apparently cheaper labour, and better climate of the South, go there to take farms which were in the market; but when they have examined the quality of the labour there, they have declined the enterprise. I am happy to find that Count Gasparin has made analogous observations. 'One day,' says he, 'our worthy and excellent colleague, M. Huzard, being consulted on the expediency of the purchase of some land in a certain canton of France, answered, 'Beware! you will not get from land there the promised return. I know the men of that country; they want activity; the pupils who come from it to our veterinary school do not strike hard upon the anvil!'' 'What fine and just appreciation!' exclaims the Count. There, where the labourer's arm is enervated, whether by physical debility, arising from a bad regime, or by long habits of idleness—there, where they do not strike hard upon the anvil, the value of the land is affected by their depression! Of old our forefathers said, 'Tant vaut l'homme, tant vaut la terre'—(as is the worth of the labourer, so is the worth of the land)."

ON SOME NEW METHODS OF TREATING LINSEED OIL AND OTHER DRYING OILS, FOR IMPROVING THEIR DRYING PROPERTIES, IN THEIR APPLICATION IN PAINTS AND VARNISHES.

SIR,—The necessarily prescribed limits—the three-quarters of an hour's time-measure—of any paper to be read before the Society, led unavoidably to the omission of much that otherwise it would have been desirable to have included in my late paper—to the omission, then, of numerous details of experiments, of processes, of the preparation of materials, of tabulated results, and of the history of researches made independently by others in the same or in a similar direction, either concurrently with or subsequently to my own, and to the period more especially referred to in my paper—as the history of those by M. Chevreul, published in 1850; of those by MM. Baruel and Jean, in 1853; the excellent lecture delivered by Mr. Calvert at Marlborough House, and the share which that gentleman (along with Mr. Hart) has had in bringing before the public the elaborate researches on oil painting of M. Chevreul. I beg, therefore, in reply to the inquiries of Mr. Hooper and others, to add to the original paper a few necessary details, merely premising that these too, must necessarily be very limited, when compared with the extent of the subject, which I hope to be able shortly to complete in a more extended publication—now in hand—on the whole chemistry of the drying oils.

I am, &c.,
CHRISTOPHER BINKS.

VI.—*Choice and Preparation of Reagents.*

It has already been said that out of those of the hydrated protoxides which have been found to exercise this specific action upon the oil, it is that of manganese which is to be selected in preference for all practical purposes. It is the fittest, because its reactions either lead to, or do not interfere with, the important issue of the final *bleaching* of the oil; and because of the extreme facility with which it, or its salts, can be obtained commercially. Several of the salts of this protoxide admit of being used for either the preparation of the hydrated oxide itself, or for its elimination, so that the salt is mixed with the oil, and is there brought in contact with some other agent to decompose it; that is, in the latter case, when there is brought to bear upon the oil the *nascent* actions that accompany the liberation of the oxide when in actual contact with the oil. For the preparation of the hydrated oxide, or for its liberation *nascently*, there may be used, at pleasure, the muriate of manganese, or the sulphate, the nitrate, the acetate, the oxalate, the borate, or others; but for all manufacturing purposes, it is from the muriate alone that the hydrated oxides should be prepared, and it is

through the medium of the sulphate alone that all the *nascent* reactions brought to bear upon the oil should be accomplished. In the manufacture of chloride of lime occurs a residue, for which there exists at present little or no use. This residue is consequently a comparatively waste product, and is daily cast away in immense quantities. It is an impure muriate of manganese, and is run out of the chlorine stills as a liquid, but on being "salted down," as it is called, can be obtained imperfectly crystallised for about £3 per ton. It contains always, a considerable quantity of iron, but this in a condition, viz., that of the permuriate, that admits of an easy separation, and consequently, of the manganese muriate, or other salt, or of the hydrated protoxide, being obtained from it of sufficient purity easily and economically by the following method:—A solution of the salt is boiled along with a little carbonate of manganese, which throws down the whole of the iron present in the form of an insoluble peroxide. To the remaining solution of muriate of manganese is added caustic soda, which throws down the hydrated protoxide of manganese, in a condition fit for immediate use in these oil operations, in those cases in which it is perferred to employ the hydrated oxide direct, and not to eliminate it *nascently* from the sulphate. When the sulphate itself is required, then to the hydrated protoxide produced as just stated, is added sulphuric acid, and the sulphate is immediately produced. For practical purposes this sulphate may remain in solution, or the excess of water present be evaporated off; and thus be obtained the beautiful rose-coloured crystals of the sulphate of manganese. This salt crystallises according to circumstances, with five or six waters of crystallisation. It effloresces on exposure to air, and the water in it subsides finally into four equivalents; and this latter is the most favourable condition in which to employ this salt, when it is preferred to use it ground up in its *solid* state with, and not to add it in *solution* in water to the oils. The crystallised sulphate so made can be manufactured for about from £12 to £18 per ton, that is, at a cost of from 1½d. to 2d. per lb. That with which the writer has hitherto carried on his large operations, was made by the Messrs. Haddock, Parnell, and Co., of Prestatyn, was perfectly free from iron, and cost only £20 per ton; and considering, besides, the exceedingly small proportion required in the operations, it will be seen how perfectly unobjectionable or even insignificant is the *cost* of these reagents. There are, of course, other well-known methods of manufacturing the sulphate of manganese; but that given above subserves two purposes—the production, at pleasure, of pure (that is, free from iron) hydrated protoxide, or of the pure sulphate; and by a proper management of these two agents, all the varieties of these new oils are to be obtained.

Why, in preference to this so readily obtained, and so cheap a salt, there should, by certain foreign chemists, (by the Messrs. J. Collin and Co., of Breslau, Silesia, alluded to by Mr. Hooper, and by MM. Baruel and Jean, of Paris, who, in their paper in the *Comptes Rendus*, in 1853, announce their preference) be made the singular choice of the *Borate* of manganese, a salt comparatively expensive and exceedingly inactive in its reactions, is scarcely to be accounted for.

VII.—*Some Details of Reactions and of Processes.*

The impolicy of adding to a paint itself, after the usual manner of a *drier*, the hydrated protoxides of manganese (or of any other of the class), or of liberating this oxide in the paint itself, by addition to the paint of some salt of manganese, will be made apparent by the following considerations, which show that it is the placing of the oil itself in a drying attitude, and the complete removal, before its admixture with the pigment, of the agents used to effect this, that we should attempt; and that we should not continue to add, after the manner of driers, these agents of change to the paint itself, and to leave them there, for in every instance such driers or additions injuriously affect the normal and the finally intended condition of the paint.

A *paint* consists of a *pigment*—the colour-giving element—and of its *vehicle;* which in the case in hand is the oil; and this vehicle should be such as in no way to interfere with the full development of the proper colour of the pigment; therefore the vehicle, if a perfect one, should itself be altogether free from colour, or be of precisely the same colour as the pigment, and, of course, to such a mixture, if we would preserve its normal condition, there should be superadded no other material calculated to interfere with the full development of the colour of the pigment. In like manner should a *varnish proper* (when not intended itself to give colour, or to modify some other colour, but merely to constitute a superficial covering, or to give a special art effect having no relation to mere colour) when a perfect one, be free from colour, so as in no way to interfere with the full effect of the underlying stratum, the pigmentary element of which has to throw out its colour through the medium of the overlying varnish.

Now, if we examine the action of these hydrated protoxides when substantively added to any paint, that is, in the form of mere *driers*, it will be seen how they must necessarily exercise an injurious action upon all paints that are lighter or are not exactly of their own colour, or of the colour they finally arrive at, and how necessarily it follows also, that a dark-coloured and non-bleaching oil, such as our ancient acquaintance, the old "boiled oil," must be altogether unfit for a varnish proper.

This hydrated protoxide of manganese, when fresh and pure, is *white* in colour, but passes speedily, by absorption of oxygen, into a *deep brown-coloured*, or nearly *black* oxide, ending finally, chemically, in the formation of the sesqui-oxide—which is nearly *black*.

$$MnO, HO \text{ (white)} + O =$$
$$Mn_2O_3, HO \text{ (brown or black)}.$$

When, therefore, the borate, or any other salt of the protoxide of manganese, say, the sulphate, is ground up with a paint, the pigment or some other element in which is capable of decomposing the manganese salt, there is liberated the protoxide; which in time (and often very speedily) passes into the sesqui-oxide; and this last oxide remaining there in this condition, leaves the paint finally and permanently tinged brown or black, the deeper in intensity in proportion to the relative quantity of the salt used.

Take the instance of the addition of the borate, or say, of the sulphate of manganese to oxide of zinc paint in order to effect the drying of the zinc paint.

First stage.

$$ZnO \text{ (in excess)}, + MnO, SO_3, HO =$$
$$ZnO \text{ (in excess)}, ZnO, SO_3; MnO, HO \text{ (white)}.$$

Second stage.

$$ZnO \text{ (in excess)}, ZnO, SO_3; Mn_2O_3, HO \text{ (dark brown or black)}.$$

If the proportion of the manganese salt thus employed be so small as finally not materially to affect the colour of the paint, then its addition in this proportion does not operate as a drier at all. But, if used in a proportion sufficient to operate as an efficient drier, then its addition becomes fatal to the colour or to the brilliancy of the paint.

It follows, therefore, that an oil paint so composed comes out, and that very speedily, not white, but yellowish-brown, or brown, or black, in accordance with the relative proportions of materials.

The employment, therefore, of the hydrated oxides, or of the salts of manganese substantively, to mix with paints as driers, is a practical fallacy. It is the same with the borate and with all the other salts of this metal, and with the whole of the hydrated protoxides of the class that exercise this drying action upon the oil. It is the

same with the preparations of lead that find their way, or issue out of the reactions of common driers, for these develop darkish-coloured compounds finally, due to and peculiar to the oxides of lead, or due to the impurities in the white copperas or in the acetate of lead used. White paints so mixed speedily assume a yellow or brownish-yellow tinge, even when no portion of this darkening can be traced to the action upon the lead of sulphuretted hydrogen. It is upon the oil itself, as a preliminary and distinct operation, in order to place it in a drying attitude, that is, to remove its colouring matter, to initiate the drying action, and to leave the oil free to the natural after reactions with the atmosphere and the other external agencies, that these preparations should be applied conjointly with the after action of the atmosphere; and every particle or trace of these intermediate agents should be (and is under some of those new methods) removed from the oil previously to its application in the composition of the paint or of the varnish.

Out of the discovery of this specific action of the hydrated oxides, there came an unlooked-for explanation of a well-known but previously anomalous fact, namely, the singular superiority for drier-making of the Hamburgh over British-made white copperas. Whilst the former was found to contain considerable quantities of both the sulphates of iron and of manganese, the latter is comparatively free from such; and to the reactions between these and litharge, and the consequent formation of the hydrated protoxides, is due the superior drying action of the Hamburgh copperas—and hence, in future, it is necessary only to add to the British a small per centage of sulphate of manganese to make its value, for these purposes, if valuable at all, equal to that obtained from the Continent.

VIII.—*Some Concurrent or Subsequent Researches by others in the same or in Similar Directions.*

The time, "now some years ago," as it is expressed, which is referred to in the former part of this paper, as that "when these investigations were first entered upon," and as that up to which there was to be found nowhere any accurate chemical history of the peculiar changes the drying oils undergo in the act of drying, &c., was the time that intervened between the period of Berthollet, of De Saussure, and the epoch—for such it became in the history of chemistry—of the original researches of M. Chevreul on the oils and fatty matters, and the year 1850. The earlier researches of the former chemists left the present question in an utterly inconclusive position, whilst the ever-famous ones of M. Chevreul himself on the oils and fats in no way touched upon it; nor did that chemist touch upon it till the year 1850, when his *Mémoire* on oil painting appeared. That there was, previously to 1850, to be found on record no systematised examination (as it is expressed by the writer), is a fact to which there could scarcely be desired a more complete testimony than that appearing in the circumstance that M. Chevreul himself, about this latter period, found it necessary to enter upon the long course of experimenting, the results of which he gives in a *mémoire* read before the *Académie des Sciences* on the 8th of June, 1850, but of course, not actually published for some considerable time after that.*

The writer began his experiments upon the phenomena of the drying of linseed oil, and for, if possible, devising some new and improved industrial method of treating the oil, in 1849, and he had fully completed his work, so far as related to the discovery of the specific action of the hydrated protoxides by January, 1850. But it was some considerable time after this that the writer worked out, as an *industrial* scheme, the combined operations of these hydrated oxides and of atmospheric air, when the latter is mechanically applied to the oil, which for some time past (the work solely of the writer) has existed as a completed process of manufacture, and is destined, unquestionably, to effect, either through his labours, or more probably through the conjoint labours of many, a complete change in this section of manufacturing chemistry.

It is singular that the researches of M. Chevreul, those of the MM. Baruel and Jean, and those, also, of the writer, had their origin under exactly the same circumstances, and out of the same necessity, viz., that which previously to 1850 had arisen out of the introduction, as a pigment, of oxide of zinc, and the demand there followed to effect the drying of its paint without the intervention of preparations of lead.

The late Mr. Knowlys, of Heysham Tower, Lancaster, being interested in the manufacture of zinc, requested the writer to devise some mode of drying the paint without the use of lead driers. The experiments, began in the autumn of 1849, were, from time to time, communicated to Mr. Knowlys, and finally the specific action of the hydrated protoxide of manganese, as developed from the protosulphate of manganese, through its reaction with the oxide of zinc, or with lime, or other matters, was shown experimentally to that gentleman, in London, in January and in the beginning of February, 1850. About the same time, and subsequently, but long before 1853, the same fact was freely communicated to several people —to the Messrs. E. B. and A. T. Pitchford, of London, to Mr. Thos. Hubbuck, of London, and to many with whom the writer met at the Great Exhibition of 1851. The Messrs. Pitchford, to whom the writer had applied for any date they might have of experiments with the hydrated protoxide of manganese shown at their works (and for which the sulphate of manganese was used, and was bought by those gentlemen), in a letter just received, say: —"In reply to your favour of this date, we have searched our books, and find that on May 21st, 1851, we purchased, under your direction, sulphate of manganese, for the purpose of making experiments on the drying of linseed oil by your new method."

MM. Baruel and Jean announce in the *Comptes Rendus* for March, 1853, their discovery of the peculiar action upon linseed oil of the hydrated protoxides of certain of the metals, especially of manganese. These gentlemen, obviously aware of some practical difficulty in the way of using these ready prepared, revert to the possibility of using their salts, but it is remarkable that they in no way intimate their perception of the fact that, through the reactions between these salts and certain decomposing agents, these hydrated oxides may be eliminated *nascently* in contact with the oil itself, and thus be realised their peculiar effects.

Now, the writer was in possession of the knowledge of those reactions at least some two or three years previous to 1853, and in possession besides of very much more relating to the practical application of the method of producing them by reactions with their salts, whilst in contact with the oil, and the conjoint or after-action of atmospheric air mechanically forced into the oil, and constituting a set or series of operations now complete. But these independently conducted researches of MM. Barruel and Jean—those of M. Chevreul, so far as identical—and those of the writer, carried on doubtless by each, without the slightest knowledge of the fact that a like or an identical line of research had been or was being pursued elsewhere, is only another instance—and a very happy one—for it tells its own tale of a common requirement giving birth to a common desire appearing in action in most remote and unlikely quarters—of the oneness both of the path and of the issues of scientific truth. It tells that the laws of matter are still—as they have ever been—the same, whether sought for in Paris or in London; and that the expressions of them must necessarily be identical, if expressed truly; and it tells that the co-issue in explanation of some of these

* Recherches Experimentales sur la Peinture à l'Huile, par M. E. Chevreul. Tome XXII. des Mémoires de l'Académie des Sciences. Paris, 1850.

phenomena—as these explanations are given in common by these French gentlemen and by the writer, which Mr. Calvert in his letter hints at as being "extraordinary"—(that is the coincidence of explanations)—is, in fact, not extraordinary at all. It would, in fact, only be extraordinary did the two explanations differ.

Between the primary object that M. Chevreul had obviously proposed to himself in his researches previously referred to, and those the writer had in view in the course of experiments carried on, as it appears, concurrently, but with no knowledge whatever of the fact on either part, there is to be observed a remarkable distinction and an equally remarkable difference in the results respectively arrived at.

The primary object of M. Chevreul was an investigation (to be conducted with all the skill, all the chemical knowledge, and the untiring perseverance to be looked for in so eminent a quarter), into the general phenomena of *oil painting*, in the course of which the special phenomena involved in the act of the drying of the oil, of its mode of preparation, and of any deductions tending to improvements in such modes, formed only sectional parts, and not the primary object of the whole,—whereas the primary and sole object of the writer in his investigations was, if possible, to discover and to determine with precision the whole phenomena of the drying of the oil, and upon that knowledge, if arrived at, to found some new method for its industrial production. The innumerable interesting phenomena, the surface developments, the molecular disturbances, the "flatting" and the "glossing" actions alluded to by the writer in his paper, were the incidental, not the primary, objects of his experiments. Whilst there is an inevitable resemblance, on some few points, in the *modes of research* adopted by M. Chevreul and by the writer, there is, at the same time, sufficient internal evidence in M. Chevreul's *Mémoire*, and in the well-known results of the writer, to mark the totally independent and different line of action of each. The writer's conclusions (shortly to be published in a forthcoming work on the "Chemistry of the Drying Oils") are in many respects widely different from those up to this period announced by M. Chevreul, whilst the writer's new methods of treating the drying oils for their manufacture, are altogether different from any appearing in this *Mémoire*, in which there is not the slightest indication (that is, up to June 8th, 1850), that M. Chevreul was aware of the specific action of certain hydrated protoxides, or that out of this fact, combined with the after action of atmospheric air, there could be obtained so happy a set of processes for the manufacture of the drying oils as it has been the good fortune of the writer to have arrived at, and to have perfected. For the fact that no such or any similar conclusion had up to this time been arrived at by M. Chevreul, there is another and a collateral kind of evidence, besides the positive one of the contents of M. Chevreul's *Mémoire*, viz., that the making of so effective a revolution in a branch of chemical manufacture as the writer's discovery and applications are bringing about, would scarcely have escaped the vigilance, the skill, and the ambition of Mr. Calvert himself, had the "master's" labours either directly stated, or suggestively shadowed forth to the pupil, the chemical facts upon which this movement, originated and followed out by the writer, is founded.

But M. Chevreul's own summary of results at the end of his *Mémoire* gives the exact extent of the practical suggestions for any improved process upon the oil itself that his previous researches had suggested. His conclusions are given in his own words. After stating that his experiments demonstrated the desirableness of some alteration in the system, on account of the cost of fuel, and of the colorisation of the "boiled oil," M. Chevreul says:—

"Puisqu'en effet j'ai démontré.

"1. Qu'une exposition d'huile à une temperature de 70° pendant 8 heures, augmente très sensiblement la propriété siccative.

"2. Qu'en ajoutant du peroxide de manganese à cette même huile chauffée de la même manière, on la rend assez siccative pour s'en servir.

"3. Qu'il suffit de chauffer une huile de lin pendant 3 heures à la temperature ou l'on opère généralement en des laboratoires de marchands de couleur avec 15 d'oxyde métallique pour 100, lorsqu'on veut obtenir une huile très siccative."

And this, if considered as a response to an urgent industrial requirement, such as that existing in the year 1850, amounts, it must be confessed, to nothing. It is merely the applying to the operation and to the old material—the protoxide of manganese—a degree of heat lower than the usual one.

IX.—*Some Special Varieties of the Oil, and Modes of Preparation.*

A drying oil would be perfect in all desirable qualities, were it free from colour, did it dry, *per se* (that is, solidify), in a reasonably short time on mere exposure to air and to other atmospheric influences, without necessity for addition to it of any other matter to hasten that result; and when thus solidified, did exhibit a compact, hard, and transparent body, and an uncrisped, smooth, and resplendent (that is, glossy) surface.

Now, some of these new processes take from linseed oil its colouring matter, and in other respects purify it entirely, whilst they leave it in a drying condition, more or less active at pleasure, without there having been added in the processes, or there being left in the oil, any foreign matter whatever, calculated to exercise any injurious action, either upon the oil itself, or upon any material mixed with it in its after applications. But it is well-known, both to artists, to decorative painters, and to varnish makers, that innumerable injurious reactions are brought about in their work by the use of the lead-prepared drying oils, with lead left in them, and of the sulphuric acid for refined linseed, through the peculiar condition in which the oil is left after the application to it of the acid and the steam.

Now, however valuable and desirable, for innumerable purposes, is such absolutely pure drying oil as that just referred to, there exist innumerable other applications in which it is neither necessary nor desirable that the oil should be so pure—in short, a multitude of cases in which it is rather advantageous than the contrary that there should remain in the oil the materials, or a portion of them, that have been used to impart to it its drying properties. Therefore, in the following tables are given formulæ for the preparation of any or of all of these varieties at pleasure.

By means of a simple but very elegant apparatus, any artist, or oil experimenter, can prepare for himself any of these varieties of the oil, and can, without inconvenience of any kind, carry on the operations in an ordinary apartment. He can operate upon a pint of twenty ounces, or upon a gallon, or several gallons, with very nearly the same beneficial results that are attained by the Messrs. Wilsons, of Liverpool, who, beginning with two-gallon operations, now prefer to operate upon five tons at a time.

The experimental apparatus which the writer uses is a stout copper pan, tinned inside, of the capacity of three gallons, but capable of working upon one pint or upon any intermediate quantity. It stands upon the table of his laboratory, is gas-heated to any degree, at pleasure, or if necessary is not heated at all, and is, at pleasure, attached to a "number one" smith's forge bellows, for sending into and through the oil the volume of air needed for these experimental quantities. Furnished with such an apparatus, with his raw oil, his thermometer, and the few reagents he requires, the experimenter in oils will have provided for himself no little source of interest in watching the peculiar changes in the oil that follow under the influence of the addition of the different materials, of different proportions of them, of different degrees of heat, and of the greater or less quantity of air sent into it.

The operations upon the oil may terminate at one or other of four different and successive stages:—

1. At the point when the re-agent used to remove the colouring matter, and initiate the drying action, has been added to and been dissolved in the oil; and this is called the *solution*.

2. At the point when through this solution there has been passed as much atmospheric air as raises the colour of the mixture to its maximum point; and this is called the *browning* of the oil, or its aëration up to the *browning* point.

3. At that point, when, through this *browned* oil there has been passed as much more atmospheric air as is required completely to *bleach* it; and this is called the *bleaching* point, or the aëration up to that point.

4. At any point when, following successively after the solution, the browning and the bleaching, it is required, by a still further addition of atmospheric air, to give to the bleached oil various degrees of thickness or of viscidity; and this is called the *thickening* point.

Now, those distinctions, that possibly may at first appear almost too minute, are, in fact, of the utmost practical value and importance, and in practice resolve themselves into results the most simple and convenient. The *solution* is applicable in innumerable painting and waterproofing work, where colour is no object, and its preparation costs almost nothing. The *browned* oil is of use for like purposes, and is a more rapidly drying oil. The *bleached* is the very perfection of a painter's oil. And the *thickened* is of itself a fine varnish, and has besides, unnumbered uses among artists, among varnish-makers, coach-painters, and very many others.

In order to tabulate the results of different methods of treating the oil, as those results appear in corresponding differences in the colour, in the degree of viscidity, in the specific gravity, and in the rate of drying of the oil, it is necessary to establish and adopt some standard of comparison. Good ordinary *refined* linseed oil is taken as one standard of colour, and is numbered 1. When the oil is lighter in colour than this, that degree is expressed as 0, that is, as having no colour whatever. Ordinary raw linseed oil is represented as 5, and the dark boiled oil as 10, on the scale. The drying rate is expressed in *hours*, which is (as explained in the former part of this paper) its rate, *per se*, under average external conditions.

There are two main classes of these oils, each class admitting of the production of the varieties of its kind that are enumerated above. These classes are—

1st. Those prepared by means of the hydrated protoxide of manganese alone, as the reacting agent, either with or without aëration.

2ndly. Those prepared by means of both the hydrated protoxide of manganese and the protoxide of lead, as the agents of reaction, and with the latter in *excess*, so as to leave the lead as well as the manganese oxide in the oil finally.

From a set of greatly more extended tabulated results, two examples are abstracted, as follows:—

Table (*No.* 1) *of Relative Proportions and Effects.*

The reagent used here is the hydrated protoxide of manganese, containing, in all, 50 per cent. of water. When of this, there are added

	There results an aerated oil, in colour.	In drying rate.
To the ton of oil, 2½ lbs. To the gallon of oil, 70 grs. To the pint of oil, 8¾ grs.	= 0	= 15 hours
To the ton of oil, 5 lbs. To the gallon of oil, 140 grs. To the pint of oil, 17½ grs.	= 1	= 12 hours
To the ton of oil, 10 lbs. To the gallon of oil, 280 grs. To the pint of oil, 35 grs.	= 3	= 10 hours

That is, the *first* proportions yield an oil lighter in colour than ordinary *refined* linseed oil, and which dries in fifteen hours.

The second proportions yield it of the same colour as *refined* linseed oil, but drying in twelve hours.

And the third proportions yield it of a colour between that of the refined and the raw oil, but drying in ten hours. The temperature used is from 80 to 100 deg. Fahrenheit.

Table (*No.* 2) *of Relative Proportions of Effects.*

The reagents used here are the crystallised sulphate of manganese, and the anhydrous protoxide of lead, the latter in *excess*.

Oil =	Ton.	Gallon.	Pint.	Colour when aerated.	Drying rate.
PbO..	5 lbs.	140 grs.	17½ grs.	= 1	12 hours.
MnO, SO_3 HO	2½ lbs.	70 grs.	8¾ grs.		
PbO.....	10 lbs.	280 grs.	35 grs.	= 5	10 hours.
MnO, SO_3 HO	5 lbs.	140 grs.	17½ grs.		
PbO..... ...	14 lbs.	392 grs.	49 grs.	= 6	7 hours.
MnO, SO_3 HO	7 lbs.	196 grs.	24½ grs.		

That is, the first proportions yield an oil of the colour of refined linseed, and drying in 12 hours *per se*.

The second yield an oil of the colour of raw oil, but drying in 10 hours *per se;* and the third yield the oil of a fine amber colour, drying *per se* in 7 hours.

From these short tables are necessarily omitted many other particulars, as the relative drying rate and colour of the *solution* and of the *browned* products, as well as of those of the *thickened* varieties; but these will be sufficient to indicate the great variety of oils this new method gives us the power to produce.

The writer would mention only one other fact relating to the production of a permanently dark-coloured oil in imitation of the old boiled oil, which he contrived, in order to gratify some who would still adhere to the old colour, and to the employment of a high temperature:—Grind up with the oil some nitrate of baryta and sulphate of manganese, and heat the mixture to about 400° Fahr.; the result is the production of a deep reddish-brown coloured and tolerably good drying oil, but one that never *bleaches*.

Now, here we have reactions, which, at a high temperature, and when out of contact with the oil, issue in the following:

$$\text{Ba O, } NO_5 + \text{Mn O, } SO_3 = \text{Ba O, } SO_3; \text{ Mn } O_2; NO_4;$$

That is, we have formed peroxide of manganese and nitrous acid. But these reactions when the elements, at the temperature mentioned, are in contact with the oil itself, issue in other and more complicated changes, leaving in the oil, finally, sulphate of baryta and sesquioxide of manganese, and leaving the oil itself of a permanent deep brown colour, and with some increased drying properties. But as the process involves the using of the old and objectionable high temperature, and the final colour is also the old one, it is mentioned here only as an example, but which as a process is in every way inferior in value to these other methods.

THE GREAT BELL AND CLOCK FOR THE HOUSES OF PARLIAMENT.

Mr. Loseby's letter of the 10th inst., in reference to this subject, having been communicated to the *Journal*, it has been thought desirable in publishing it to reprint Mr. Loseby's first letter and Mr. Denison's reply, which have appeared in other papers.

SIR,—Notwithstanding the appearance of a leading article in the *Times* of Nov. 7, to the effect that a distinguished

lawyer, Mr. E. B. Denison, Q.C., had, fortunately for mankind, been specially raised up by Providence to restore the art of bell-founding, and discover improvements in turret clocks, there are a few simple matters of fact which require to be brought forward, or the public may find, when too late, how little the anticipations so modestly announced in the *Times* have been realised.

In the first place, the chief fact, that the bell is intended for the clock, and will be struck by the clock hammer, and not by an immense clapper, appears to have been thrust into the back-ground; for we were told, several weeks ago, that the bell had been tried with a clapper of 700lbs., impelled by the force of five or six men, who had failed to bring out the full tone; and we are now informed that a clapper of 1,600lbs. is being prepared for the purpose; and the same notices lead us to understand that the official trial of the bell will be decided by this enormously disproportionate clapper instead of by the clock hammer, with which it will have to be used.

On looking over the different parliamentary returns on the subject, to ascertain the size of the clock, I find it is sufficiently large to lift a hammer of 120lbs., and give it a fall of six inches, with the clock going eight days; and it is further stated, that this proportion of weight and fall will be amply sufficient to bring out the tone of the large bell, provided it is of an average quality. Indeed, instances are mentioned in which the proportions are much smaller, as it is stated that the great bell of Oxford, weighing 152 cwt., only requires to be struck by a hammer of 54lbs., falling 4½ inches.

From the same returns we gather that the bell is to be supplied by the contractors, subject to the approval of competent referees on the part of the government, who will be deputed to ascertain if its merits are of the highest order, and if they are not, the bell is to be rejected. It is difficult to collect from the returns who the referees are at the present moment. At one time Mr. Denison and a gentleman nominated by him were appointed to the office, and more recently the duty appears to have devolved on Sir Charles Barry and Professor Wheatstone, but as other changes may have occurred, by which the responsibility no longer rests with the latter gentlemen, I think it better to make the following suggestions through the press, lest in the number of changes the duty of the referee should fall to the ground and be reduced to a dead letter.

1. That the bell, before being accepted, should be placed in the position it is to occupy in the tower, and then tried with a hammer of about 120lbs., falling, by its own gravity alone, through a space of 6 inches; and as this is the force which will be employed upon the bell when in use, it is obviously that which should be employed in all the experiments that are to determine its fitness for the purpose it is intended for, and any effect which may be produced on the bell by a clapper of 1,600lbs. urged by the force of eight or nine men through a space equal to the whole width of the mouth, should be regarded as altogether beside the principal question.

2. That if the quality of the tone proves satisfactory, the referees should proceed to note its volume by stationing themselves at different distances from the tower in and about the neighbourhood of London, in order to compare the quantity of sound produced by this and other known bells; due allowance being made for the difference of size, the direction of the wind, and the state of the atmosphere, &c.

3. That as the bell has being designed by Mr. Denison, if it should so fall out that he and his friend at present occupy the position of referees, it would afford more scope for impartiality in the judgment about to be pronounced if Mr. Denison, and perhaps his friend also, were to retire from the office, and leave the task of deciding on the merits of his work in other hands, particularly as this is the first public instance in which Mr. Denison's views on the subject have been brought to the test of practice, and the referees are to determine whether the bell shall be purchased by the government or not.

E. T. LOSEBY.

London Nov. 12, 1856.

SIR,—Mr. Loseby's statement, that it appears from the parliamentary papers that the Westminster clock is calculated to strike the bell with a hammer of only 120 lbs. raised 6 inches, is a pure and simple fabrication of his own, as anybody may see who will take the trouble to look at the contract, which was printed in 1852, and again in 1855. And any body who chooses to look at my latest book "On Clockmaking" (not the rudimentary treatise, but a reprint of the article in the "Encyclopædia Britannica," sold at Dent's, in the Strand), will see that a hammer of 4 cwt. falling 12 inches—nearly eight times Mr. Loseby's figures—was the least that I contemplated in designing the clock. The hammer will in fact be considerably more than this, as the bell is not only heavier, but much stronger than I ventured to expect three years ago.

I have been wondering what could suggest to Mr. Loseby such an absurdity as the striking of a bell of 16 tons with a hammer of 120 lbs.; and perhaps this is the explanation:—It does appear, from the parliamentary papers he refers to, that—not before, but—after the intended weight of the bell had been increased from that of the Oxford bell to 14 tons, a hammer of little more than Mr. Loseby's size was proposed, in that very plan for the clock which his fraternity, the Worshipful Company of Clockmakers, memorialised the Commissioners of Works to adopt, and to rescind (if they could) Mr. Dent's contract to execute my plan. It is only charitable to suppose that, writing with an imperfect recollection of the papers, and animated by a natural and amiable desire to pay off some old scores respecting his chronometer grievances, Mr. Loseby has, with a curious felicity of blundering, transferred the folly of the company of clockmakers to my account.

E. B. DENISON.

SIR,—After partly divesting Mr. Denison's letter, published in the *Builder* of Dec. 6, of the peculiar tone and epithets which pervade it, the matter resolves itself into the following:—

First. That the proportions of weight and fall given in my communication, viz., 120 lbs. for the hammer, and 6 inches for its fall, are "fabrications" of my own, and not to be found in the parliamentary papers, unless I have, as Mr. Denison expresses it, "blunderingly transferred the folly of the company of clockmakers to his account." Second. That in designing the clock he made provision for its having to lift a hammer of 400 lbs., and give it a fall of 12 inches, and that evidence is to be found of his having long contemplated this as the least quantity of work which the clock would have to do, and further, that now the bell has been cast, he finds even this weight and fall of hammer will have to be considerably increased.

In reply to the first part, I have to state that, before writing the letter to which Mr. Denison refers, I carefully examined all the published parliamentary returns to the House of Commons, viz., No. 724, Session 1847; No. 257, Session 1848; No. 500, Sssion 1852; and No. 436, Session 1855; and that I have since gone diligently through them again, and the result is that I have not found any inaccuracy or error whatever in my former statement. The weight of 120 lbs. and 6 inches fall, are neither "fabrications" of my own, nor were they quoted according to Mr. Denison's other suggestion, from the "blundering statements of the company of clockmakers," but were taken from a table given by the late Mr. Dent, at page 56, parliamentary return, No. 724 of 1847; and, let me add, that I purposely confined myself throughout the letter to the quantities and figures given by Messrs.

Dent and Denison themselves, thinking that the latter gentleman would not then question their accuracy.

In reply to the second part, I have to observe that I can find no mention throughout the whole of the returns, either from Mr. Denison or any one else, that a hammer of 400 lbs. falling 12 inches would probably be required for the bell, which it was understood, before the first return was published in 1847, was to weigh from 14 to 15 tons. Neither has any provision been made, by enlarging the clock, for the enormous, and still accumulating, increase of work which Mr. Denison, in order to get his bell purchased by the government, seems now disposed to throw upon it. The main striking-wheel remains at 3 feet diameter, and it has never been increased beyond this size in any of the plans of Messrs. Dent and Denison, from the date of the first return in 1847, to the last return in 1855, and at this date the clock had been made.

In justice to the late Mr. Vulliamy, I must remark that the plan for the clock which was sent in by him, and which Mr. Denison ridicules, under the title of the fraternity of clock-makers' plan, as being too small for the purpose, was larger than any of the plans proposed by Messrs. Dent and Denison, as the diameter of Mr. Vulliamy's main striking-wheel was 3 feet 7 inches. Nor is this the only advantage in durability which Mr. Vulliamy's plan exhibits over Mr. Denison's, for it had gun-metal wheels throughout, whilst the wheels in the clock that has been made are all of cast-iron, the commonest and cheapest material that could be used; nor is this all for which the public have to thank Mr. Denison, Q.C., for he has so managed matters that the government will have to pay as much for the clock as though it had been made of the more durable and costly material.

In conclusion, I again set forward the principal questions to be kept in view:—

1. What is the force which the clock now made is calculated to lift? To this, I reply, that, taking into consideration the size of the striking part, the time it should last, and the fact of the wheels being composed of cast-iron, 120lbs. for the hammer and 6 inches for its fall, is the greatest quantity of work which the clock should be allowed to do.

2. What is the force which a good bell of 16 tons should require? To this I reply that, taking the Oxford bell as the standard, which weighs 152 cwt., and is struck by a hammer of 54 lbs., falling 4½ inches, and considering that Mr. Denison's bell was to have been much superior to the average quality, a hammer of 120 lbs. falling 6 inches ought to be amply sufficient to bring out the tone.

E. T. LOSEBY.

London, Dec. 10, 1856.

NOTICE TO MEMBERS.

The Labourers' Friend Society has placed in the hands of the Secretary of the Society of Arts, 100 copies of a Report by their Honorary Architect, H. Roberts, Esq., on the late Brussels Congress for the Improvement of the Condition of the Labouring and Indigent Classes.

Mr. T. Twining, jun., has deposited a limited number of copies of the Catalogue of the Brussels Exhibition of Domestic Economy, and a printed list of books, pamphlets, and other documents bearing on the condition of the working-classes, which have been presented to the Society of Arts, and are arranged for reference in the Society's Library.

Copies may be had on application to the Secretary.

Home Correspondence.

BUILDING-TRADE PATTERN-BOOKS.

SIR,—Permit me to call the attention of such manufacturers as seek to bring the articles they produce under the notice of architects and others, by means of illustrated circulars and trade lists, to the waste of time, trouble, and therefore money, caused by the inadequacy for practical purposes of the information they generally supply.

Within these last few weeks I have received, as have, no doubt, very many others, in my profession, some half-dozen picture-books, many evidently got up at very considerable cost, and evidencing a most satisfactory progress in design and technical ingenuity.

Of this half-dozen, scarcely one gives any notion, either by scale or figuring, of the size and substance of the objects represented; prices are either not at all indicated, or, if indicated, are expressed so vaguely as to form no guide whatever to the real cost of the articles.

What an architect really requires, if these pattern-books are to be of any use to him, are the following conditions:—

1st. Each object (if in the least degree complicated) to be given in plan, section and elevation.

2nd. Each object to be drawn to scale, and the scale put upon each plate.

3rd. Each object to have its leading dimensions figured as well.

4th. The best mode of attachment of each object to adjoining work to be clearly shown.

5th. Such a concise description of each object to be given, as to enable the architect to define the same in his specification, without risk of confusion or mistake.

6th. The price of each object complete, as engraved, to be marked beneath or near to the engraving; any suggested variations, either of enrichment, or tending to simplification, to be also priced; and attention to be drawn to probable cost of fixing, painting, gilding, or any necessary process not included in the first price quoted.

Illustrated price lists of articles for the use of all persons connected with the building trades, prepared in accordance with the preceding conditions, become most valuable sources of reference to professional men; whereas, if only pretty picture books, they are just looked over, thrown on one side, and then either put upon the bookshelves, perhaps never to be taken down again for years, or, after lying about for a week or two, are thrown into the waste-paper basket, as of no use. On the other hand, in an architect's office, a well arranged pattern-book is constantly referred to, and articles are drawn and specified from it, of course to the benefit of the manufacturer. If an architect knows that Brown's No. 3, or Jones's 24, or Robinson's 102, are just the right size and style for Mr. Smith's house, which he has got to build, and will cost such an amount as he thinks Mr. Smith can afford to pay, he at once determines to introduce the aforesaid numbers 3, 24, or 102, although, very possibly, some other manufacturer may, at the very same time, be making better and handsomer articles at a lower price.

Let us suppose that, seduced by a pretty picture-book,, without scales or prices, the architect is tempted to write respecting some work he wants done, to the person who sent him the aforesaid picture-book. He receives a reply, giving him the particulars the pattern-book ought to have supplied, and from the manufacturer's note he learns that the article he supposed to be about 4 feet long is 6 feet 6 inches; and that what he expected would cost £5 will cost £7 10s. He then writes to know if size and price can be modified. The manufacturer says, in return, that any modification can be made; will the architect send a sketch? The architect makes his sketch, and the manufacturer finds that the alteration, although diminishing the quantity of material, will, through the additional labour, cost more than the original £7 10s. The architect does not think the article worth the money, and, in his client's interest, declines to purchase. Everyone has had his trouble for nothing, and discontent is, of course, the result. If even the article should be procurable at the architect's price, £5, the five shillings

his commission will procure him in return for his own and his clerk's time wasted, offers no very great premium to future transactions with the sender of the pretty but foolish picture-book.

Pray, believe, Sir, that I am drawing no fanciful picture, but one of daily occurrence. My only inducement to sketch it has been my sincere belief that, in the rapid introduction into the building trade of improvements in the quality and technical treatment of old and new materials, lies the secret hope we can have of an ultimate escape from the enfeebling tradition in architecture to honourable and national originality. It seems to me that the organ of the Society of Arts, which does so much to foster, and, indeed, to generate all such improvements, should convey this hint, which I do not think it will prove unprofitable for those manufacturers whom it may concern to attend to.

I am, &c.,
M. DIGBY WYATT.

54, Guilford-street, Russell-square.

MEN AND MANUFACTURES.

SIR,—A friend has just put into my hand your number of the 21st of November, containing a paper on this subject, by Mr. W. Bridges Adams. The drift of it seems to be, that, in the opinion of Mr. Adams, we should do well, as a nation, and economically speaking, to transfer our cotton manufacture from the present cotton districts of Lancashire and Lanarkshire to the Nerbudda districts in India. In support of this opinion, Mr. Adams makes one or two assertions which, to me, are somewhat astonishing. And, as I am tolerably familiar with the Lancashire cotton district, and have for some years given close attention to the best statistical data hitherto available, touching the present and indicating the probable future condition of our increasing town-population, as well in that district as elsewhere, and I find my own conclusions widely at variance on some material points with those of Mr. Adams, I venture to ask of that gentleman, through you, a further elucidation of some parts of his argument.

The first assertion of which I desire to see some proof is the following:—"Lancashire cannot grow men and women, for if she ceased to import them, they would disappear in a few generations, *i.e.*, men and women fit for cotton-working." I have at hand the returns of the population of every county in Great Britain, at the date of each of the six censuses taken since (and including) 1801. If Mr. Adams will be so kind as to point out among these materials, or in the Irish censuses, such as they are, taken during the last fifty years, or in the Reports of the Emigration Commissioners, or, in short, in any public documents accessible to the public, the particular returns, or other evidence, on which this assertion is based, I shall feel, and be ready to acknowledge, a considerable obligation.

To put the question in the form least likely to be misunderstood, I would suggest that it be assumed that the cotton manufacture, as now carried on in Lancashire, were brought to a stand-still, not to increase or diminish, —and that Lancashire were called upon, with its present population, to maintain it at its present level for two or three generations, without importing men and women. This will avoid any question as to how far the importation hitherto going on has been required to meet the continuous expansion of the trade. And if Mr. Adams will state the process of induction by which, his facts being given, he elicited from them the conclusion I doubt the veracity of, he will confer an additional obligation.

Having hitherto been of opinion that the cost of capital and of labour were both lower (allowing for the effective value of the labour) in Lancashire than in any other cotton-manufacturing district out of Great Britain, I should be glad to learn on what grounds it is that (looking at the effective value of the labour) Mr. Adams assumes that labour applicable to the manufacture, as now carried on in Lancashire, could be had in India at one-fourth of the cost now paid in Lancashire, or at any cost materially less. Also, whether Mr. Adams has considered the cost of the capital, fixed and floating, requisite for investment in India, to carry out his scheme; and if so, on what ground he assumes, as he appears to do, that here there would be, if no advantage in, yet no obstacle to, the change he proposes.

I do not overlook the prophetic character of what Mr. Adams asserts; and I am quite aware that, the period of fulfilment being unfixed, I may have taken up, as of immediate and practical interest, what was not so intended. If this be so, a word from Mr. Adams may set me right, and not only me, but, if I am not mistaken, many others, to whom everything that affects the present or approaching condition of this great branch of our national industry has a deep interest.

I am, &c.,
J. T. DANSON.

Carnsdale Farm, Barnston Birkenhead.

Proceedings of Institutions.

WATERFORD.—At the Mechanics' Institute, on Wednesday evening, the 12th inst., the second course of lectures was commenced by George Barker, Esq., author of "The White Squall," "Mary Blane," and other musical compositions, who appears to have given great satisfaction to a large audience.

To Correspondents.

Errata.—At page 57, column 2, line 1, at bottom, and line 3 from bottom, for "could" read "should;" and line 6 from bottom, for through," read "though." At page 71, column 2, line 24, for "Miss," read Messrs."

MEETINGS FOR THE ENSUING WEEK.

MON. Actuaries, 7.
London Institution, 7. Dr. Tyndall, "On the Nature and Phenomena of Light."
TUES. Royal Institution, 3. Professor Faraday, "On Attraction."
WED. London Institution, 3 Professor Rymer Jones, "On Vivaria and their Inhabitants."
FRI. Archæological Inst., 4.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December 19th*, 1856.]

Dated 21th October, 1856.

2518. John Fordred, Islington—Improvements in lamps, in apparatuses connected therewith, and in manufacturing certain liquids for the production of light. (Partly a communication.)

Dated 22nd November, 1856.

2772. William Kemble Hall, London—Improvements in machinery for cutting, punching, and shaping metals.
2779. William Edward Newton, 66, Chancery-lane—Certain improvements in railway carriages. (A communication.)

Dated 25th November, 1856.

2791. John Bond, Burnley, Lancashire—Improvements in machinery for counting and indicating the number of revolutions performed by rollers and shafts.

Dated 26th November, 1856.

2799. John Musgrave, jun., Globe Iron Works, Bolton-le-Moors—Improvements in the construction of cloth beams for beetles.

Dated 28th November, 1856.

2814. Peter Walker, Warrington—Improvements in brewing, and in the machinery or apparatus employed therein,
2816. Camille Auguste Tissot, 39, Rue de l'Echiquier, Paris—Improvements in the production of motive power, and in the apparatus connected therewith.
2818. Joseph M. Saunders, 16, Westmorland-street, Dublin—Improvements in cooking ranges.
2822. Michael Allen, 39, Cavendish-grove, Wandsworth-road—Improvements in the slide valves of steam engines.

Dated 29th November, 1856.

2824. Charles William Siemens, John-street, Adelphi—Improvements in fluid meters.

2826. William Johnson, 47, Lincoln's-inn fields—Improvements in projectiles. (A communication.)
2828. Laban Clarke Stuart, New York—Improvements in machinery for reducing fibres to pulp. (A communication.)
2830. Edwin Senior Atkinson, Knottingley, Yorkshire—An apparatus for condensing vapours, fumes, gases, and smoke arising from chemical and smelt works.
2832. Richard Harmer, 12, Princes-street, Spitalfields—Improvements in stereoscopic pictures.

Dated 1st December, 1856.

2834. Charles Henry Gilks, Union-row, Tower-hill—An improved stand for umbrellas for railway and other carriages.
2836. John Gedge, 4, Wellington-street South, Strand—Improvements in lubricating the journals of the axles of railway vehicles or other moving parts of machinery. (A communication.)
2838. John Coope Haddan, Cannon-row, Westminster—Improvements in pianofortes.
2842. George Julius Vertue, Northam, Southampton—An improvement in deodorising sewage waters and sewage matter, when lime is used.
2844. John Carter Ramsden, Bradford, Yorkshire—Improvements in apparatus for the mechanism of looms for weaving a certain class of plaids, checks, and fancy woven fabrics.
2846. Noel Monnier, Paris—Improvements in bridles and bits for stopping horses.

Dated 2nd December, 1856.

2848. Frederick Cornwall, Birmingham—Certain improvements in the construction of fire-places applicable for general purposes, whereby combustion is rendered more perfect and capable of regulation or controul, smoke thoroughly consumed, and the draught in open fire-places much increased.
2850. Richard Archibald Brooman, 166, Fleet-street—Improvements in pumps and in pumping. (A communication.)
2852. Richard Archibald Brooman, 166, Fleet-street—A chemical composition or agent to be employed in the dyeing of wools and woollens. (A communication.)
2854. Louis Dominique Girard, Paris—Certain improvements in hydraulic turbines.
2856. James Apperly, Dudbridge, Gloucestershire—An improved fabric applicable to the manufacture of feed cloths or aprons.
2858. Matthew Townsend, Leicester—Improvements in machinery for the manufacture of knitted fabrics.
2860. John Hall Brock Thwaites, Bristol—An improved screw bolt, or fastening, for ship building and other purposes.

Dated 3rd December, 1856.

2863. Philipp Kurten, Cologne, Prussia—Improvements in the manufacture of mottled soap and yellow soap.
2864. Frederick Albert Gatty, Accrington—Improvements in the construction of filters or drainers.
2865. Emory Rider, Cannon-street—Improvements in the manufacture or treatment of gutta percha, being improvements upon the invention secured to me by Letters Patent, dated the 20th day of July, 1852.
2867. Adam Bullough and William Bullough, Blackburn—Improvements in looms.
2868. Henry Genhart, Liège, Belgium—Improvements in fire-arms and ordnance, and of the cartridges or projectiles to be used therewith.
2869. Julien Denis, 14, Queenhithe—Improvements in apparatus for corking and uncorking bottles without leaving any air between the liquid and the cork. (A communication.)
2870. Joseph Deeley, Mile-end-road—Improvements in furnaces for smelting and melting.
2871. James Kinder Cheetham, Rochdale, Lancashire—Improvements in the application of photographic pictures to metal and other surfaces, and in rendering the same applicable as printing surfaces.
2872. William Edward Newton, 66, Chancery-lane—Improved processes for ornamenting metallic surfaces, and for producing surfaces in intaglio, or in relief, for printing purposes. (A communication.)

Dated 4th December, 1856.

2873. Aimé Lecocq, France—Improvements in hydraulic engines.
2874. James Apperly and William Clissold, Dudbridge, Gloucestershire—Improved machinery for preparing fibrous substances for spinning.
2875. Louis Bayer, Soho—An improved stuffing to be used in place of hair or other substances in which such articles are commonly employed.
2876. Isaac Livermore, 5, Shrubland-grove East, Queen's-road, Dalston—An improvement in waterproofing paper.
2877. Laban Clarke Stuart, New York—Improvements in drying sized paper. (A communication.)
2879. Daniel Barnard and David Lichtenstadt, 29, High-street, Whitechapel—Improvements in tanning.
2880. John Simon Holland, Woolwich—Improvements in the manufacture of iron, part of which is applicable to other purposes.
2881. William Henson, Buckingham-street, Caledonian-road, Islington, and Henry Palmer, Newman-street, Oxford-street—Improvements in sewing or stitching machines.
2882. Auguste Edouard Loradoux Bellford, 10, Bedford-street, Strand—Improvements in drying, burning, and cooling bricks, tiles, and other ceramic substances. (A communication.)
2883. Louis Joseph Frederic Margueritte, Paris—Improvements in treating materials to be used in manufacturing retorts, crucibles, bricks, and other kinds of earthenware.
2884. David Crawford, Glasgow—Improvements in washing, cleansing and preparing textile fabrics and materials.

Dated 5th December, 1856.

2885. Robert Davison and Joshua Crowther, Lansdowne Factories, Limerick—Improvements in machinery for winding yarns or thread on bobbins or pirns fixed on spindles driven by gear or cogged wheels, and for winding weft, for either hand or power looms.
2886. Henry Moore, New Windsor, Berks—A boot and shoe stud.
2887. William Klœn, Birmingham, and Daniel Jones, Liverpool—An improvement or improvements in photography.
2888. Thomas Earp, Newark—An improved cutting apparatus for reaping and mowing machines.
2889. Alexander Grant, Clement's-court—Improvements in shirts. (A communication.)
2890. Lodewyk Polak Kerdyk, Manchester—Certain improvements in machinery or apparatus for extracting colouring matters to be employed for the purposes of dyeing, or for other similar processes.
2891. William Clyburn, Lombard-street—Improved machinery for making butter.
2892. Heth Ogden and Henry Hibbert, Salford—Improvements applicable to colliery and locomotive engines for the purpose of arresting or retarding their motion at required intervals, and of indicating the amount of work done in relation to such intervals.

Dated 6th December, 1856.

2893. William Hooper and Joseph Fry, Mitcham, Surrey, and George Nasmyth, Bucklesbury—Improvements in springs for railway carriages, and for other purposes.
2895. William Stettinius Clarke, 133, High Holborn—Improvements in combined caldron and furnace for agricultural and other purposes. (A communication.)
2897. James Perry, Ballymoney, Antrim, Ireland—Improvements in the treatment, application, and use of mineral tar for the production of oleaginous and lubricating matter and fuel.
2899. John Horace Taylor, Bunhill-row, and Philip Marcus, Well-street—An improvement in irons for ironing.
2901. Stephen Randoll Smith, Bristol—Improvements in anchors.

Dated 8th December, 1856.

2905. Richard Eaton, 2, Sussex-terrace, New-road, Battersea—An improvement in the manufacture of springs when India rubber is used.
2907. James Bertram, Edinburgh—Improvements in steam engines.
2999. Benjamin Carless, Birmingham—An improved bird cage.
2911. Edward Burwell, Gainsborough, Lincoln—An improvement in roasters for coffee, cocoa, chicory, and similar substances.

Dated 9th December, 1856.

2913. Joseph Lillie, Manchester, and Arthur Dobson, Belfast—Improvements in machinery or apparatus to be used in the processes of drying animal, mineral, and vegetable substances.
2915. Thomas Vicars, sen., Thomas Vicars, jun., Thomas Ashmore, and James Smith, Liverpool—Improvements in the manufacture of biscuits, lozenges, and other like articles of confectionery.
2917. John Rawson, Bury—Improvements in lubricators.
2919. John Robinson Scartliff, Wolverhampton—Improvements in apparatus to be employed as an alarm and detector in cases of burglary.
2221. William Seggie Carr, New York—Improvements in water-closets.
2923. Hector Mollet, Newlay, near Leeds—An improvement in fulling woven woollen fabrics.
2925. John Thornett, jun., New North-road—Improvements in gas-burners.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2933. Louis Vignat, 3, Place des Victoires, Paris—A new slide beater with one or more shuttles applicable to any loom whatever for weaving all kinds of tissue.—11th of December, 1856.

WEEKLY LIST OF PATENTS SEALED.

December 19th.

1774. John Macintosh.
1441. George Tillett.
1443. Francis Gybbon Spilsbury.
1445. Theodore Schwartz.
1453. James Bullough.
1456. Michael Thomas Crofton.
1462. Elias Robison Handcock.
1465. William Valentine Miller.
1470. James Atkinson Longridge.
1471. George Riley.
1472. John Miller.
1476. Charles Mills.
1479. John Saxby.
1481. Joseph Harrison and Christopher Gelderd.
1499. James and Richard Kenyon.
1511. William Hudson and Christopher Catlow.
1522. Bevan George Sloper.
1525. William McAdam.
1557. Thomas Emmanuel Marais.
1558. John Williamson and J. Cochran Stevenson.
1567. Joseph Brown.
1573. John Henry Johnson.
1577. Joseph Adshead.
1585. Robert Millward.
1593. Henry Smith.
1607. Robert Martineau and Brooke Smith.
1649. William Petrie.
1679. Adolphus Frederick Gurlt.
1725. John Edward Hodges.
1740. Samuel Frédéric Berthiez.
2477. Alfred Vincent Newton.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

December 16th.

2939. George Anderson.
2943. Isaac James.
3022. Alfred Vincent Newton.

December 17th.

2937. Joseph Sharp Bailey.